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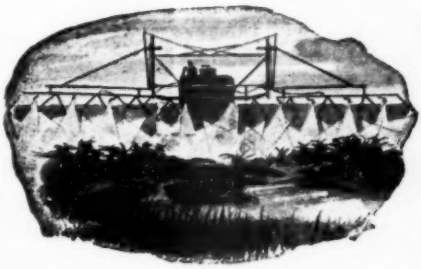

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ORGANIC FUNGICIDES FOR LATE BLIGHT IN CONNECTICUT

JAMES G. HORSFALL AND NEELY TURNER[1]

Connecticut Agricultural Experiment Station, New Haven, Conn.

The importance of organic pesticides on potatoes waxes as the importance of Bordeaux mixture wanes. At present disodium ethylene bisdithiocarbamate and its more stable relative zinc ethylene bisdithiocarbamate are coming into the field as fungicides for late blight.

Disodium ethylene bisdithiocarbamate (hereafter called by its nickname "Dithane" for short) has been studied on potatoes almost ever since its babyhood here in 1941 (2). It was evident early that the material had insufficient insecticidal qualities to compete with Bordeaux mixture on Connecticut Valley potatoes. It soon made a place for itself, however, (6) on late blight in Florida, where the insecticidal action of Bordeaux is at a minimum.

Heuberger and Mann's discovery (3) of the salutary influence of zinc sulfate and lime on disodium ethylene bisdithiocarbamate elevated it from the level of mediocrity into a promising material for late blight. This did not provide insecticidal qualities, and hence, the material still had no place in the Connecticut Valley, but with the advent of DDT in 1944 to control insects, its fungicidal role began to show in true perspective. This paper will serve to record experiments with it and other fungicides on potatoes in 1944, 1945 and 1946.

[1]The authors wish to thank R. W. Barratt, Arthur Kelman, and A. D. McDonnell for much assistance in the field work.

Materials and Methods

Two types of methods were used in the work—intensive and extensive. The intensive work was done on the Station farm at Mt. Carmel, Connecticut. Plots in 1944 and 1945 were single rows 10 feet long, randomized in four blocks. The sprayer was a typical three-nozzle to the row arrangement mounted on bicycle wheels. Specifications for application were 200 pounds pressure, 3/64 inch orfices, 200 gallons per acre. There were four doses of each pesticide with a dose ratio of two. The technique in 1946 differed only in that the plots were of three rows, 23 feet long and the dose ratio for the pesticides was three. Data were taken from the center row only. With the exception of 1946, the data given are the means of all four doses and the four replicates of each, making sixteen determinations for each reading.

Insect damage and late blight reading were based on the grading scale described by Horsfall and Barratt (4).

The extensive work was done on farmers' farms, with their equipment and labor in 1945 and with our commercial equipment and labor in 1946.

Results in 1944

Two experiments were performed at Mt. Carmel in the severe drought year of 1944, one on Cobblers in which only flea beetles were involved, and one on Green Mountains where both flea beetles and leafhoppers were involved. No late blight occurred in either plot.

Data are given in table 1. The data show that Dithane either alone or plus zinc sulfate and lime is almost without effect on leafhoppers or flea beetles. Its chemical relative, tetramethylthiuram disulfide (Thiosan, now Tersan), was somewhat better, but far inferior to DDT. The deduction is obvious. However, good dithiocarbamates might be for the control of late blight, they could never succeed alone in the Connecticut area where flea beetles and leafhoppers are usually serious.

1945 Results

In 1945 another test was run on late-planted Katahdins (June 1) using Bordeaux, Dithane plus zinc sulfate and lime all season, DDT spray all season, and DDT spray all season plus Dithane plus zinc sulfate and lime beginning on the 30th of July shortly after the onset of blight. The season was abnormally wet so that blight developed heavily, but leafhoppers and flea beetles were not very serious. This was the opposite of 1944. Data are given in table 2.

TABLE 1.—*Effect of two dithiocarbamates, DDT and Bordeaux on potatoes in a blight-free year.*

Treatment	Green Mountain				Cobblers			
	Per cent Tip Burn		No. Leafhoppers per Leaflet		Yield, Bu. per Acre	Per cent Flea Beetle Damage	Per cent Dead Foliage	Yield, Bu. per Acre
	Aug. 4	Aug. 13	July 18	Aug. 2		June 5	July 11	
DDT dust[1]	22.4	74.0	8.0	9.3	140	8.4	16.9	163
Dithane[2] alone	43.9	88.0	36.8	44.5	118	18.5	39.4	131
Dithane[2] + $ZnSO_4$ + lime	42.4	85.8	30.0	31.5	134			
T M T D[2]	31.5	80.8	30.5	29.8	137	12.9	21.7	146
Bordeaux mixture[3]	35.1	82.4	37.5	39.2	128	13.1	26.6	134
No treatment	49.8	82.4	35	38	132	19.0	34.5	144

[1]Results are the means of four dosages 4, 2, 1 and 0.5 per cent active ingredient in dust.

[2]Results are the means of four dosages 4, 2, 1, 0.5 lbs. of active ingredient per 100 gallons. Zn SO_4 used at corresponding ½ rate and lime at ¼ rate.

[3]Results are the means of four dosages 2, 1, 0.5 and 0.25 lbs. of active ingredient per 100 gals. Lime used at corresponding ½ rate.

Since the season was opposite to 1944 the results were opposite. Dithane outyielded DDT as much or more in a wet season with few insects as DDT outyielded Dithane in a dry season with no disease. It is obvious that each organic must supplement the other in a complete potato spray. Since forthcoming events are said to cast their shadows before, it is noteworthy that Dithane outyielded Bordeaux even though it produced no better disease control.

Several farmers in the Valley compared Dithane with Bordeaux during the blight epidemic of 1945. The yields from large unreplicated plots on those farms where records were taken are given in table 3. Where records were taken, DDT was used for insect control.

TABLE 2.—*Effect of Dithane plus Zinc sulfate and lime with and without DDT, Bordeaux and DDT on potatoes in a blight year.*

Treatment	Per cent Leaf Area Blighted	Yield, Bushels per Acre
DDT all season[1]	61	171
DDT all season[1] Dithane[2] after July 30.	18	214
Dithane[2]	17	231
Bordeaux[3]	14.5	205
No treatment	71	132

[1]Results are the means of 4 dosages 1, 0.5, 0.25, and 0.125 lbs. per 100 gallons.
[2]Results are the means of 4 dosages 4, 2, 1, 0.5 lbs. active ingredient per 100 gallons. Zn SO_4 at ½ rate. Lime at ¼ rate.
[3]Results are the means of 4 dosages 16, 8, 4, 2 lbs. active ingredient per 100 gallons. Lime at equal rate.

TABLE 3.—*Effect of Dithane plus DDT and Bordeaux plus DDT on commercial farms under late blight and insect conditions,* 1945.

Farmers	Variety	Yield in Bushel per Acre		
		Bordeaux	Dithane	Net Change
Daigle	Chippewa	290	290	0
Daigle	Katahdins	249	274	+25
Wetstone	Green Mountain	325	360	+35
Ellsworth	——	308	271	−37
Bahler	Green Mountain	414	452	+38

In general Dithane outyielded Bordeaux in the commercial fields as it did on the experimental plots.

Experience with farmers in 1945 showed one other significant fact. Farmers who used calcium arsenate as an insecticide with Dithane in 1945 seemed to obtain inferior blight control and lower yields than farmers who used DDT as an insecticide. This confirms laboratory research which shows that calcium arsenate reduces the stability of Dithane.

1946 Results

In the intensive project in 1946, the basic objective was to investigate the interactions between five fertilizer levels and four concentrations of Bordeaux and Dithane. For the purposes of this report the five fertilizers and four doses are pooled to give a mean based on 80 plots for each fungicide. There were two checks in each fertilizer, making 20 untreated plots.

Late blight attacked about mid-August. Three readings for late blight were made on the 22d and 27th of August and the 10th of September. Yields were taken after the plots died down. Data are given in table 4.

Whatever else may come out of the complex experiment upon later analysis, it is quite clear again in 1946 as in 1945, that the Dithane and Bordeaux gave essentially equal disease control, but that Dithane outyielded the Bordeaux by approximately 20 per cent.

In 1946 some large scale potato spraying tests were made on commercial farms. The plots were 10 rows wide, and about 700 feet long (approximately ½ acre each) in two randomized blocks. They were sprayed at 400 pounds pressure with commercial equipment using four nozzles (3/64"D) per row. Weekly applications from the 1st of July to the 7th of September were made using Dithane plus zinc sulfate and lime, zinc ethylene bisdithiocarbamate, 2,3-dichloronaphthoquinone (Phygon) and yellow cuprous oxide (Cuprocide). The first treatment was repeated on all five experimental farms, the second on four, the third on two, and the fourth and fifth on one each. One-half pound of active DDT was added to each 100 gallons of all sprays except where hexachlorocyclohexane was used. It was also used at a concentration of one-half pound of total chemical (not gamma isomer) per 100 gallons.

Late blight struck fairly heavily in the Valley as shown by the destruction in poorly sprayed fields. Little disease showed in the treated blocks. There was some Botrytis especially in the Bordeaux-sprayed blocks. There were distinctly more aphids in the Bordeaux-sprayed plots than on the others. The data are recorded in table 5. It

TABLE 4.—*Effect of dithane and bordeaux mixture each with DDT on flea beetles, leaf scorch, and late blight.* 1946.

Treatment	Dosage. Lbs. per 100 Gallons.		Per cent of Foliage Area Blighted			Yield. Bushel per Acre
	Fungicide	DDT	Aug. 22	Aug. 27	Sept. 10	
Bordeaux	18-9	2	Trace	Trace	2.30	310
	6-3	.67	Trace	0.45	6.50	311
	2-1	.22	0.50	0.80	35.50	270
	.67-.33	.07	4.34	6.80	92.40	176
Dithane	6	2	0	Trace	0.80	373
	2	.67	Trace	Trace	2.85	355
	.67	.22	0.65	0.98	52.50	253
	.22	.07	4.36	9.20	92.90	216
No Treatment	—	—	17.0	70.0	98.27	137

TABLE 5.—*Effect of dithane, bordeaux, zinc dithane, cuprocide, and phygon all with DDT under late blight and insect conditions,* 1946.

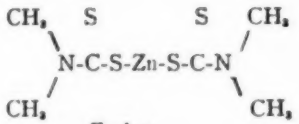
Farmers	Bordeaux Mixture	Lithane Plus Zn SO_4 Plus Lime	Zinc Dithane	Phygon	Cuprocide	Zinc Dithane Plus Hexachloro-cyclohexane
Grant	498	480	—	422[2]	—	—
Ellsworth	333	370	444	—	—	—
Clark	260	295	—	—	—	—
Cohen	490	505	—	—	425	—
Hutton[1]	444	—	520	—	—	470

[1]4 half-length replicates instead of two

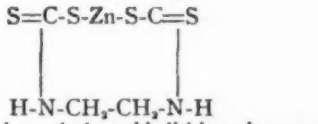
[2]only one replicate.

is clear again that the organic dithiocarbamate outyielded the Bordeaux in three of the four fields. The zinc salt outyielded both in the two fields tried.

One farmer independently compared the two zinc dithiocarbamates, zinc dimethyl dithiocarbamate (Zerlate) and zinc ethylene bisdithiocarbamate. The late blight attacked the former much earlier and was more severe than on the latter. Verbal reports say that the same situation obtains in other areas. This type of result is sufficient to demonstrate that the configuration of the molecule is of great importance in fungicidal and protective action. Both molecules contain one atom of zinc and both contain two dithiocarbamate radicals, but the performance on late blight is radically different. The two molecules are shown herewith:



Zerlate



zinc ethylene bisdithiocarbamate

It is worthy of note that zinc dithane contains a replaceable hydrogen in the secondary amine. Barratt and Horsfall (1) have suggested that the double bond to the sulfur can oscillate between the sulfur and the nitrogen and form the isomeric—SH compound which is probably more active than the original.

It seems very significant that disodium ethylene bisdithiocarbamate plus a small amount of zinc sulfate and lime should outyield Bordeaux mixture even though it does not control late blight any more effectively. This suggests the obvious conclusion that the Bordeaux is more injurious to the potatoes than the organic material (5). Research in several regions (5) has already indicated that the lime in Bordeaux contributes to its injuriousness. Although the dithiocarbamate spray contains some lime, it contains much less than the Bordeaux mixture.

In this connection it is further significant that the zinc salt, by the same reasoning, was less injurious than the sodium salt plus zinc sulfate and lime. The zinc salt contains no lime whatsoever.

Summary

This paper briefly reports three years research on new fungicides especially dithiocarbamates on potatoes in Connecticut. Dithane, first tested here in 1941, and reported in 1943 has long been under test for late blight of potatoes. It has succeeded in areas like Florida where flea beetles and leafhoppers are of minor consequence. Until the advent

of DDT to control these two pests, dithiocarbamates could not succeed elsewhere. The data reported herein suggest that dithiocarbamates, particularly Dithane, are not much if any better than Bordeaux mixture in the control of late blight, but they do permit the potatoes to set a larger yield.

It is suggested that this is due to a lower level of phytoxicity which, in turn, is due to low lime content of the Dithane.

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OBSERVATIONS ON THE USE OF POTATO VINE KILLERS IN THE RED RIVER VALLEY OF NORTH DAKOTA[1]

WM. G. HOYMAN[2]

North Dakota Agricultural Experiment Station and State Seed Department, State College Station, Fargo, N. Dak.

The use of potato-vine killers in the Red River Valley of North Dakota is a recent practice and only a small percentage of the growers have used one or more of the products available for that purpose. A satisfactory killer is needed to advance the date of harvest in order that growers of certified seed may ship to southern states and Cuba for early-fall planting. In years when killing frosts occur late it would be desirable for most growers, and especially those with large acreages, to kill the vines in order that harvesting may proceed before the arrival of inclement weather. Although late blight, caused by *Phytophthora infestans,* has occurred occasionally since its first report on North Dakota potatoes in 1942, vine killers would be useful in preventing the spread of this pathogen and in reducing the amount of tuber rot reported (1) in tubers harvested from late-blight-infected vines. During years of excess moisture late in the

[1]Commercial companies cooperating in the work included the American Cyanamid Company, the Dow Chemical Company, F. H. Peavey and Company, and Standard Agricultural Chemicals, Inc.

[2]Associate Plant Pathologist, North Dakota Agricultural Experiment Station and State Seed Department.

season, vine killing would also be desirable in order to arrest tuber size and second growth.

In order to determine the effectiveness of some of the various products available for vine killing, experiments were conducted in growers' fields and at the North Dakota Agricultural Experiment Station and State Seed Department plots at Grafton, North Dakota, during the latter part of the growing season of 1946. The plots varied in size from 2 to 8 rows wide and 80 to 300 feet long. A power-take-off, Bean sprayer and tractor-mounted, Niagara duster were used for applying the materials. The former was fitted with nozzles that delivered a hollow-cone or fan-type spray pattern. Pressures of 400 and 200 pounds were maintained with the respective types and either gave satisfactory coverage. Since climatic conditions affect the action of herbicides, the official rainfall record at Grafton, from the 1st of May through the 25th of September 1946, is given in table 1.

TABLE 1.—*Rainfall record at Grafton, North Dakota, from May 1 through September 25, 1946.*

Day	Month				
	May	June	July	August	September
1					
2				.04	
3	.18			.15	
4	.17		.04		
5	.10				.02
6	.01	.15	.04		
7		.24	.55		
8					
9	.13			.14	
10			.10		
11			.08		
12					
13					
14	.43				
15				.02	
16		.10			
17	.19	.03	.07	.78	.07
18				.02	2.54
19	.08				1.29
20		.02			
21				.30	
22		.13			.57
23			.20		.25
24		.70			.05
25					
26		.97		1.53	
27				.23	
28		1.15			
29		.24			
30					
31					

The first application was made on the 1st of August with Dowspray 66 Improved at 2 gals. per 100 gals. of water in a field of early-planted Red Warbas. The temperature was 83° F. the evening the spraying was done and the effectiveness, as indicated by the rapidity of kill in table 2, was rated at 4. Weed Killer A dust and spray, Micropulverized AERO Cyanamid dust and spray, Pulverized AERO Cyanamid dust, Sinox, 2 concentrations of Sinox General, ammonium dinitro butyl phenol, and Dowspray 66 Improved were applied to Bliss Triumph vines on the 15th of August when the temperature was 75 to 80° F. No dew was observed on the foliage at the time or 10 days following the application. The ratings in table 2 indicate the dusts were very ineffective. Weed Killer A at 50 lbs. per 100 gals. of water was the most rapid killer. The next applications included Weed Killer A spray, Micropulverized AERO Cyanamid spray, Dowspray 66 Improved with and without aluminum sulphate, ammonium dinitro butyl phenol, 3 concentrations of Sinox General, and Sinox. The treatments were made on the 19th of August in a field of Pontiacs that had an abundance of vine growth. During the applications the temperature ranged from 74 to 83° F. Weed Killer A at 37.5 lbs. per 100 gals. of water was very effective (rating of 1) and Dowspray 66 Improved with 2 lbs. of aluminum sulphate was given a rating of 2. Poorest of this group were Micropulverized AERO Cyanamid and 1½ pts. of Sinox General with 1 gal. of diesel oil.

Four concentrations of phosphoric acid, ammonium dinitro butyl phenol with ammonium sulphate, and Sinox General with and without ammonium sulphate were applied to Bliss Triumphs on the 4th of September. The temperature ranged from 68 to 72° F. The ratings indicate phosphoric acid killed slowly at the lowest concentrations and fairly rapid at the highest (10 gals.) concentration. Phosphoric acid was injurious to certain parts of the Bean sprayer and had to be handled with care. The effectiveness of ammonium dinitro butyl phenol and Sinox General was increased by the addition of ammonium sulphate. The final tests were made on the 6th of September with Weed Killer XA. It was used at 16, 33, and 50 lbs. per 100 gals. of water when the temperature was 55° F. The results indicate it was not as effective as Weed Killer A or some of the other materials.

An unexpected observation 2 days following the application of Dowspray 66 Improved on the 1st of August was the brown discoloration present within and adjacent to the vascular (conductive) tissue of a majority of the Red Warba tubers (Fig. 1, A). An examination of the vines disclosed the discoloration was also present in the petioles, stems, and stolons. Steinbauer (5) has reported a slight discoloration of the

TABLE 2.—*The effectiveness of various potato-vine killers.*

Vine Killer	Method of Application	Quantity per 100 Gals. Water	Quantity per Acre	Effectiveness[1]
Dowspray 66 Improved	Spray	1 gal.		5
Dowspray 66 Improved	Spray	2 gal.		4
Dowspray 66 Improved	Spray	1 gal., 2 lb. aluminum sulphate		3
Dowspray 66 Improved	Spray	2 gal., 2 lb. aluminum sulphate		2
Weed Killer A[2]	Spray	37.5 lb.		1
Weed Killer A[2]	Spray	50 lb.		1
Weed Killer A[2]	Dust		100 lb.	7
Micropulverized AERO Cyanamid	Dust		100 lb.	7
Micropulverized AERO Cyanamid	Spray	66 lb.		6
Pulverized AERO Cyanamid	Dust		60 lb.	6
Weed Killer XA[2]	Spray	16 lb.		5
Weed Killer XA[2]	Spray	33 lb.		4
Weed Killer XA[2]	Spray	50 lb.		4
Sinox	Spray	1½ gal., 8 lb. ammonium sulphate, 1 gal. diesel oil		5
Sinox General	Spray	1½ pt., 2 gal. diesel oil		6
Sinox General	Spray	2 pt., 3 gal. diesel oil		4
Sinox General	Spray	1½ pt., 1 gal. diesel oil		6
Sinox General	Spray	3 pt., 5 gal. diesel oil		3
Sinox General	Spray	1½ pt., 5 lb. ammonium sulphate, 2 gals. diesel oil		2
Sinox General	Spray	2 pt., 5 lb. ammonium sulphate, 3 gal. diesel oil		2
Ammonium dinitro butyl phenol	Spray	5 pt., 1 gal. diesel oil		6
Ammonium dinitro butyl phenol		1 gal., 3 gal. diesel oil		4
Ammonium dinitro butyl phenol	Spray	1 gal., 5 lb. ammonium sulphate, 2 gal. diesel oil		3
Phosphoric acid[3]	Spray	2½ gal.		6
Phosphoric acid[3]	Spray	5 gal.		6
Phosphoric acid[3]	Spray	7½ gal.		5
Phosphoric acid[3]	Spray	10 gal.		4

[1]1=Leaf blades dead within 48 hours, 2 to 5 inclusive = increasingly less effective, 6 = 90 per cent or more of leaf blades dead 10 days after treatment, and 7 = very little death at 10 days.

[2]Furnished by the American Cyanamid Company. The nature of the active ingredient has not been disclosed.

[3]Anaconda phosphoric acid analyzing 77 per cent.

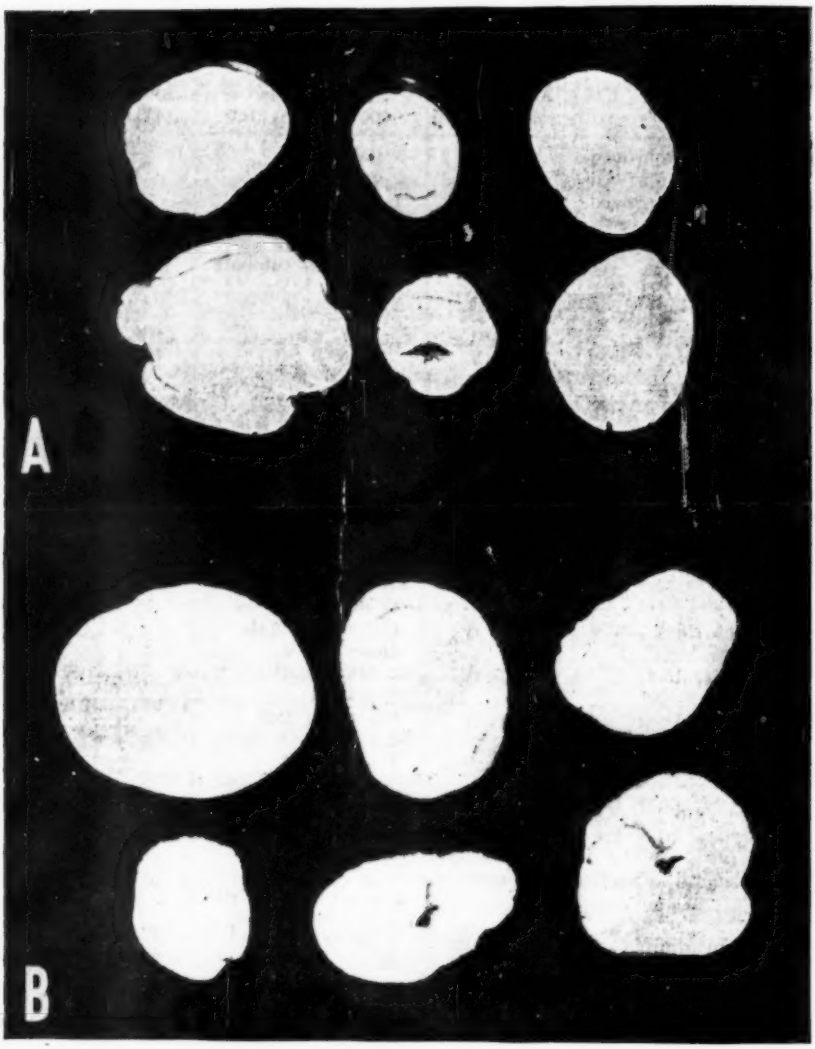

FIG. 1. A. Discolored Red Warbas harvested from vines sprayed with Dowspray 66 Improved. B. Discolored Pontiacs harvested from untreated, cut vines. Normal tubers at upper, left-hand corners.

vascular bundles of tubers sometimes occurs in Maine following the application of vine killers, especially dinitro compounds. His report calls attention to the fact that similar discolorations may sometimes occur in untreated tubers from drought, vine injury, etc., and do not alter the seed value or cooking quality. On the 19th of August, the stems of several untreated Pontiac vines, in the same field and near the plots that were

sprayed with vine killers the same day, were cut on a level with the adjacent soil. When the tubers from these cut vines were examined on the 4th of September, some of them showed the same type of discoloration (Fig. 1, B) present in tubers harvested from sprayed vines. The recent report by Otis (3), concerning vine-killing experiments in Oregon, may be cited as further evidence supporting the variable occurrence of discoloration in tubers harvested from plants treated with vine killers. Some of the chemicals used in Oregon were also tested in Maine and North Dakota but no discoloration was reported at the former location. Although the vine killers may or may not have a direct effect on tuber discoloration, an examination of many potatoes indicated that the rapidity of kill was positively correlated with the amount of discoloration. For example, Sinox General at 1½ pts. and 1 or 2 gals. of diesel oil per 100 gals. of water was a slow killer (rating of 6) and produced a small amount of tuber discoloration. When a more rapid kill was obtained by the addition of ammonium sulphate there was an increase in the amount of discoloration. Weed Killer A may be cited as another example. When used as a dust it was very ineffective and produced no tuber discoloration but when applied as a spray the discoloration was common. A further observation indicated the amount of discoloration was less when the applications were made later in the season. The type of discoloration shown in figure 1 is not the same as that recently described by Larson and Albert (2) or Ross (4). It is also not typical of the discoloration caused by certain *Fusarium* species.

Conclusions

1. Nine vine killers were applied as sprays or dusts to potatoes at Grafton, North Dakota, at various times from the 1st of August to the 6th of September, 1946.
2. In the absence of dew, the dusts were not effective.
3. Weed Killer A at 37.5 or 50 lbs. per 100 gal. of water was the most rapid killer.
4. The effectiveness of Dowspray 66 Improved was increased by the addition of aluminum sulphate.
5. The addition of ammonium sulphate to Sinox General and ammonium dinitro butyl phenol increased the rapidity of kill.
6. The discoloration found in and near the vascular (conductive) tissue of tubers harvested from treated vines may or may not be a direct effect of the vine-killing chemicals.
7. Tubers harvested from untreated, cut vines showed the same type of discoloration present in tubers harvested from vines treated with vine killers.

8. The amount of discoloration was positively correlated with the rapidity of kill and was less when the applications were made later in the season.

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PROMISING NEW INSECTICIDES FOR CONTROL OF POTATO INSECTS IN WESTERN WASHINGTON

LOYD L. STITT

State College of Washington, Institute of Agricultural Sciences, Agricultural Experiment Station, Western Washington Experiment Station, Puyallup, Wash.

A dust mixture consisting of 25 per cent calcium arsenate, 25 per cent monohydrated copper sulfate, and 50 per cent hydrated lime has been the standard treatment used in this region for the control of potato flea beetles and late blight. Aphids and leafroll, a virus disease, have caused much concern to potato growers in this area during the past few years. In 1946 several new insecticide-fungicide combinations were tested in an attempt to control the several potato troubles more adequately and, indirectly, to increase production. Data on the effect of certain new materials when mixed with a fixed copper compound were compared with those obtained by the standard control method.

One series of dusts consisted of DDD (1,1,dichloro-2,2-bis(p-chlorophenyl)-ethane), 5 per cent; DDT, 5 per cent; DMT (1-trichloro-2,2-bis(p-methoxyphenyl)-ethane), 5 per cent; and benzene hexachloride (1,2,3,4,5,6 hexachlorocyclohexane), 0.5 per cent gamma isomer. The percentage of toxicant in each dust was based on weight. Each of the above dusts was mixed with Copper A Compound (tetra copper calcium oxychloride) to contain 6.75 per cent metallic copper. The diluent used in formulating the dusts was a commercial grade of talc (Stauffer's Superfine, Stauffer Chemical Co.). To reduce dust drift, one per cent petroleum oil (S.A.E. 20) was added to each dust except the standard commercial calcium arsenate.

A second series of dusts consisted of 5 per cent DDT mixed with tetra copper calcium oxychloride (Copper A Compound), 45 per cent copper; tribasic copper sulfate (Tennessee 53), 53 per cent copper; red copper oxide (Stauffer), 80 per cent copper; and tribasic copper sulfate (Acme Kopper King), 52 per cent copper. Copper equivalent to 6.75 per cent was used in each dust. The red copper oxide was very coarse, so a fungicide of finer particles was preferred. The same type of talc and oil was used as in series 1. Data from this series were obtained to check the compatibility of DDT with different fixed copper fungicides.

Insecticide-fungicide combinations were applied as dust as this has been the standard method of application. These were applied by a four-row (engine-propelled) duster at the rate of 15 pounds per acre for the first dusting and the amounts gradually increased as the plants grew until 40 to 45 pounds were necessary when the plants were large enough to cover the space between the rows. The first application of dust was made when 75 per cent of the potato plants had emerged from the ground. Dustings were made on the 6th, 12th and 19th of July, the 4th, 14th and 26th of August and the 8th of September to the Netted Gem variety. Each of these randomized plots located at Arlington, Washington, consisted of eight rows, 135 feet long. Each treatment was replicated six times.

Data were obtained on populations of potato flea beetles, aphids, flea beetle tuber infestation, late blight tuber infection, and yields.

Data and Discussion

Flea beetle population and tuber infestation.—The control of adult potato flea beetles[1] was very satisfactory in all eight treatments. This conclusion is based on the number of beetles captured by sweeping the potato plants.[2] More flea beetles were captured in the six plots dusted with the standard calcium arsenate treatment than the sum totals taken from the 42 plots treated with the seven other treatments. Flea beetle populations were extremely low in the plots dusted with DDT and other new insecticide-fungicide mixtures.

The tuber flea beetle larvae (*Epitrix tuberis* Gentner) tunnels into the tuber and may reduce the grade of the potatoes. In this experiment, populations of this species as obtained by sweeping do not show definite

[1]The tuber flea beetle (*Epitrix tuberis* Gentner) and the western potato flea beetle (*E. subcrinita* Lec.).

[2]Ten sweeps with a standard 14-inch collecting net were taken in each plot, or a total of 60 per treatment, on each of the following: 18th of July, 4th, 14th, 19th and 26th of August. Only 4 plots (40 sweeps) were sampled on 7th of September.

relationship with the amount of tunneling. These data are shown in table 1.

TABLE 1.—*Adult flea beetle populations and tuber tunnels in comparable sweep-net and tuber samples, respectively, from plots treated seven times with various insecticide-fungicide dusts. Arlington, Washington*—1946.

Treatment	Number of Adults in 340 Sweeps	Total Number of Tubers Tunneled in 300	Means for Tunnels in 6 Replicates
Calcium arsenate 25 per cent—monohydrated copper sulfate 25 per cent—hydrated lime 50 per cent[1]	39	36	6.0
DDD[2] 5 per cent—Copper A Compound (abbreviated CAC)[3]	4	29	4.8
DMT[4] 5 per cent—CAC	3	54	9.0
Benzene hexachloride[5] 0.5 gamma isomer—CAC	6	21	3.5
DDT 5 per cent—CAC	5	18	3.0
DDT 5 per cent—Tennessee 53[6]	3	29	4.8
DDT 5 per cent—Red copper oxide[7]	7	27	4.5
DDT 5 per cent—Acme Kopper King[8]	3	29	4.8
Difference required for significance (5 per cent level)			3.3
Difference required for significance (1 per cent level)			4.5

[1]Standard calcium arsenate dust—Stauffer Chemical Co., San Francisco 8, California.
[2]DDT supplied by Röhm and Haas, Philadelphia, Pennsylvania.
[3]Supplied by E. I. duPont deNemours and Co., Tacoma, Washington.
[4]Supplied by E. I. duPont deNemours and Co., Wilmington, Delaware.
[5]Supplied by E. I. duPont deNemours and Co., Wilmington, Delaware.
[6]Product of Tennessee Corporation, Lockland, Ohio.
[7]Product of Stauffer Chemical Co., San Francisco 8, California.
[8]Product of Acme White Lead and Color Works, Detroit, Michigan.

Data on the number of tubers tunneled and the number of tunnels per tuber were obtained by paring 50 tubers from each plot. There were never as many as ten tunnels found in any one tuber. The tubers were selected at random from the middle two rows. Potatoes in the plots dusted with the DMT-CAC had the largest number of tubers injured by tuber flea beetle. Reduction in tuber flea beetle infestation was significant in plots dusted with DDD-CAC, DDT-Tenn 53, DDT-red copper oxide, and DDT-Kopper King in comparison with plots dusted with DMT-CAC. The decreased infestation in plots treated with benzene hexachloride-CAC, and DDT-CAC was highly significant as compared with DMT-CAC plots.

Effect of different treatments on aphid populations and disease incidence.—Macrosiphum solanifolii (Ashmead). *Myzus persicae.* (Sulzer), and *M. convolvuli* (Kalt.) were the aphids[3] found in the potato plots. Population trends observed during the dusting season from the 6th of July through the 8th of September reached peaks on the 14th and 26th of August. Aphid numbers increased rapidly between the 4th and 14th of August and declined rapidly between the 26th of August and the 7th of September.

The reduction of aphid populations in plots treated with the new insecticides was highly significant as compared with the standard calcium arsenate treatment. There was no significant difference between the mixtures containing new materials in the remaining seven treatments.

Aphid populations were compared in plots treated with the four insecticide materials (series 1), (DDD, DMT, benzene hexachloride, and DDT). Benzene hexachloride-CAC treatment significantly reduced the aphid populations over the DDD-CAC treatment. The mean differences in aphid populations between benzene hexachloride-CAC, DDD-CAC, and DDT-CAC treatments were highly significant as compared with the means of aphid populations in the DMT-CAC treatment. A difference of 22.0 in the means of aphid populations (table 2) was significant and a difference of 30.4 was highly significant.

In comparing aphid populations in the plots treated with DDT and different fungicides (Series 2) our analysis shows no significant differences.

Data from this experiment indicate that the different fungicides did not alter the effectiveness of DDT in controlling the aphids on potatoes.

Evidence shows that the incidence of net necrosis was very low in the samples of potatoes collected from the insecticidal-fungicidal plots. The amount of net necrosis did not reduce the commercial grade of the potatoes. Plots dusted with calcium arsenate and DMT-CAC showed three tubers in sixty, or 5 per cent, with net necrosis, and it is interesting to observe that aphid populations were the highest in these two treatments.

Fungicides as used in this experiment kept the late blight under commercial control. In checking the tubers for flea beetle injury, records were kept on the number of tubers infected with late blight. Only six tubers in 2400 examined from samples of all the different treatments

[3]Determinations were made by Dr. G. F. Knowlton, Utah State Agricultural College, Logan, Utah.

showed evidence of late blight. This infection (table 2) was fairly uniform among the different treatments.

TABLE 2.—*Populations of aphids and amount of disease in different insecticidal-fungicidal plots. Arlington, Washington,* 1946.

Treatment	Aphid Numbers in 300 Sweeps[1]	Number of Tubers Showing	
		Net Necrosis[2]	Late Blight[3]
Calcium arsenate 25 per cent, monohydrated copper sulfate 25 per cent, and hydrated lime 50 per cent	737.5	3	1
DDT 5 per cent—CAC (Copper A Compound)	48.0	0	1
DMT 5 per cent—CAC	98.8	3	1
Benzene hexachloride 0.5 gamma isomer—CAC	19.2	1	2
DDT 5 per cent—CAC	27.5	0	0
DDT 5 per cent—Tennessee 53	35.0	0	0
DDT 5 per cent—red copper oxide	26.0	0	1
DDT 5 per cent—Acme Kopper King	30.8	0	0
Difference required for significance (5 per cent level)	84.2		
Difference required for significance (1 per cent level)	103.0		

[1]Figures are the means of six replications. Ten sweeps per plot (or 60 per treatment) were taken on the 18th of July, 4th, 14th, 19th and 26th of August.

[2]Ten tubers per plot sample or 60 tubers per treatment were examined by Dr. Leo Campbell, Plant Pathologist, Western Washington Experiment Station, Puyallup, Washington.

[3]Numbers of tubers showing late blight infection per 300 tubers examined.

Potato yields in plots treated with different insecticide-fungicide combinations.—Yields of harvested potatoes were consistently higher in plots treated with the new combinations than in the standard calcium arsenate treatment. These differences varied from 2442 pounds to 4051 pounds per acre.

Differences of mean yields in all treatments except DMT-CAC show high significance as compared with the standard calcium arsenate treatment. DMT-CAC treatment was significantly better than calcium arsenate treatment. There was no difference in yields between DDD-CAC, DMT-CAC, benzene hexachloride-CAC, or DDT-CAC treatments. Also, when each of the four different fungicides were mixed with DDT there was no significant difference in yields.

Mechanical injury to the potato plants caused by dusting equipment.—Data obtained at harvest time indicated that mechanical injury to the potato plants during dusting applications reduced yields. This

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TABLE 3.—*Effect of insecticidal-fungicidal treatment of yields of potatoes. Arlington, Washington*—1946.

Treatment	Mean Yields per Plot	Calculated Yields per Acre
	Pounds[1]	Pounds
Calcium arsenate 25 per cent, monohydrated copper sulfate 25 per cent, hydrated lime 50 per cent	1,740	23,526
DDD 5 per cent—CAC (Copper A Compound)	1,991	26,770
DMT 5 per cent—CAC	1,932	25,968
Benzene hexachloride 0.5 gamma isomer—CAC	2,051	27,577
DDT 5 per cent—CAC	1,981	26,632
DDT 5 per cent—Tennessee 53	1,982	26,645
DDT 5 per cent—Red copper oxide	1,991	26,770
DDT 5 per cent—Acme Kopper-King	1,974	26,535

Difference required for significance (5 per cent level) 145.6
Difference required for significance (1 per cent level) 195.3
[1]Figures are means of six replications.

reduction was 1000 pounds on the acre basis. No appreciable injury to the vines was observed during the first three dustings but as the plants became larger an increasing amount of damage was observed during the last four applications.

The plots consisted of eight rows. The center rows, numbers 4 and 5, were free from injury as only the duster boom and nozzles traversed the plants in these rows. In rows 3 and 6, the tractor and duster wheels injured vines on only one side of the rows. The tractor and duster wheels traveled on one side and the duster wheel on the other side of rows 2 and 7. Because of the dusting arrangement, the tractor wheels made two trips on one side of rows 1 and 8 and the duster wheels made one trip on the other side.

An analysis of these yield data indicated that different intensities of mechanical injury influenced the potato yield. The differences in mean yields were highly significant between rows injured on both sides or twice injured on one side and once on the other side as compared with rows injured on one side or rows not injured by the dusting equipment. Significance in mean yields occurred between rows injured on both sides and rows twice injured on one side and once on the other.

Information from this experiment shows that mechanical injury to the vines by dusting equipment reduced potato yield. Potato fields dusted by the growers would not necessarily give the same results or the same arrangement of variations in injury, as reported above, because of varying types of equipment.

TABLE 4.—*Effect of mechanical injury resulting from the operation of dusting equipment on the yields of potatoes. Arlington, Washington.* 1946.

Amount of Injury	Means of 48 Plot Yields in Pounds
No injury (Rows 4 and 5)	513.5
Injured on one side (Rows 3 and 6)	505.2
Injured on two sides (Rows 2 and 7)	474.3
Injured twice on one side and once on the other side (Rows 1 and 8)	463.4
Difference required for significance (5 per cent level)	10.7
Difference required for sigificance (1 per cent level)	14.2

SUMMARY

Dusts containing DDT, DDD, DMT or benzene hexachloride in mixture with CAC (Copper A Compound) fungicide were superior to standard calcium arsenate mixture for the control of flea beetles and aphids in 1946 at Arlington, Washington. However, tuber infestation by flea beetle larvae was greater in plots treated with the DMT-CAC mixture than in plots treated with any other combination of materials.

Net necrosis and late blight were apparently controlled commercially by the different insecticide-fungicide dust mixtures used in 1946.

The differences in mean yields of plots treated with DDD-CAC, benzene hexachloride-CAC, DDT-CAC, DDT-Tennessee 53, DDT-red copper oxide, and DDT-Acme Kopper King were highly significant compared with those of plots treated with standard calcium arsenate mixture. Potato yields in plots dusted with DMT-CAC were significantly better than yields in plots treated with standard calcium arsenate mixture.

No significant differences in yields of potatoes were obtained between plots treated with DDT, DDD, DMT or benzene hexachloride when each of these insecticides was mixed with CAC. Effectiveness of DDT, when mixed with four different copper fungicides, showed no significant difference in the control of aphids or in yields of potatoes.

Mechanical injury to potato vines by tractor-drawn dusting equipment reduced the potato yields. Various intensities of mechanical injury caused significant to highly significant differences in potato yields.

MERCHANDISING, BY-PRODUCTS AND POTATO PACKAGES

KRIS P. BEMIS

United Fresh Fruit and Vegetable Associaton, Washington, D. C.

The potato industry finds itself in 1946 in a position where it is consuming a great many less potatoes than it produces. This year's crop totaled about 474 million bushels, whereas the Government's records of utilization show only about 280 to 300 million bushels entering into the fresh channels of sale annually. The rest of the crop has been going for seed, for livestock feed, for export, for relief, and into various products and by-products. When production was averaging around 400 million bushels or less, these outlets were required to consume roughly 100 million bushels. Present production figures require that outlets be found for an additional 80 million bushels.

The problem of making potato supply and demand meet involves either increasing all forms of consumption, decreasing production, or both. Much has been said about a crop control program for potatoes, involving both acreage reduction and some form of penalty for marketings in excess of quotas. Too little has been heard about permanent long-range efforts to increase consumption of fresh potatoes, manufactured potato food products, and non-food by-products. Although it is clear that consumption cannot overtake present levels of production immediately, there is no reason why a broad campaign for utilization will not yield favorable results.

Per capita consumption of potatoes, according to Government figures, has been declining for several years. In the five-year period ending in 1929, it was 156 pounds. Five years later it was 147 pounds. In 1934, it had declined to 138 pounds, and in 1939, had reached the low figure of 131 pounds. It should be noted that the consumption of practically every other fruit and vegetable, except apples, had enjoyed a steady increase. Citrus consumption during the same period went up from 29½ pounds per capita to 48.7 pounds. It so happens that during that period some 40 million dollars was invested in advertising and sales campaigns on citrus fruits. Potato consumption has suffered partly because of poor grading and unattractive packaging, partially from the aggressive competition of other starchy foods, somewhat from the prevailing opinion that potatoes are fattening, but most of all from the lack of a concerted merchandising effort on the part of the potato industry itself. As for the development of potato food products, this

has resulted, with one of two significant exceptions, principally from the efforts of independent processors outside the fresh potato business. Dehydration developed rapidly during the war, and is now undergoing a downward readjustment to peacetime conditions. The potato chip industry has grown rapidly, in spite of wartime shortages of fats and oils, and now consumes about 15 million bushels of fresh potatoes annually. It is doubtful if the sale of potato flour and meal has any more than kept pace with the increased population, wartime expansion considered. Some developments are taking place in the field of frozen cooked potatoes and it may be said that these show great possibilities, but more research along these lines is necessary.

What is being done to increase the consumption of fresh potatoes? One of the most promising projects, so far as this organization is concerned is found in the work of United's Merchandising Institute. It has been proved, through a carefully conducted commercial research program, that the sale of all fresh fruits and vegetables can be increased by the application of certain tested principles in retail stores. It has been found that there is a balance within a retail fruit and vegetable department as to the quantities of different fruits and vegetables purchased by the average consumer. When this fact is recognized and the retail store undertakes a definite program of merchandising along carefully-planned lines, startling increases in sales volume have occurred. In other words, the sale of potatoes at retail can be increased as a part of the program of increasing the sale of all fresh fruits and vegetables at retail.

Following a year of careful preparation in a number of wholesale markets, United held at Kansas City, last November, a two-and-one-half-day Merchandising Clinic attended by nearly 300 industry men from the United States and Canada. Here the proven systems and methods required for setting up a successful and profitable green-grocer department in the retail store were carefully explained, studied, and discussed. Even though such a meeting may seem a small beginning, the enthusiasm with which the idea has been received is very promising for an extension of its principles. The fresh fruit and vegetable industry is nothing if not a chain of more or less independent links. Unlike other businesses, it is seldom under vertical control, but consists of different operations managed by different groups. Even though you can pull a chain successfully, nobody ever got very far trying to push one. For that reason, the United Merchandising Institute goes first into the retailer's place of business to find out why there is not a strong pull through his green-grocery department, to find out

where the bottlenecks are, and to help him reorganize his produce business on a sound basis.

How can potato consumption be increased in manufactured food products? It has already been pointed out that some progress has been made in selling more chips, more frozen French Fries and certain processed potato products designed for the preparation of quick meals. Clearly more research, both public and private, is needed, in the development of these products, in finding their markets, and in publicizing them through both advertising and public relations programs. The potato chip manufacturers present an excellent example of aggressiveness along these lines.

In the manufacture of potato by-products, such as alcohol, starch, livestock feed, etc., a vicious circle is encountered. Manufacturers are unable and unwilling to invest capital in processing equipment and factories where a reasonably steady supply of raw materials cannot be assured. On the other hand, the industry has done practically nothing in an organized way to keep its culls and off-grades off the fresh market and to make them available at salvage prices to such outlets. Some way must be found to get this chain of supplies, production and use into circulation.

We have seen this year some 20 million bushels of surplus potatoes manufactured into beverage alcohol and more than six million bushels into industrial alcohol. This was a piece of luck to the potato industry and the Government, caused by the world-wide shortage of grain; but the large grain crops of the past summer have turned the distilleries away from the use of potatoes. So long as Government subsidy is to be applied to the handling of potato surpluses, and this has been the case for over twelve years, many express the belief that Government-supported manufacture of alcohol for potatoes is not impossible. Its use as a blend in motor fuel has long been a distinct possibility.

Research is under way to determine whether potato starch, as such, has any uniquely advantageous qualities. It competes with starch from corn and from various plants grown in the tropics, which tends to keep it on a low price basis. The only exception seems to be its use in the textile industry. Similar research is under way as to the possible development of crude glucose to be made from cull potatoes and used in the manufacture of livestock feed. More activity is needed to develop this outlet. Foreseeing the need for stimulation from within the industry, of both private and public research, United established, almost a year ago, a permanent committee for the promotion of research and by-products use. This committee, with membership representative

of many potato-producing areas, has already undertaken a broad program to translate its objectives into accomplished facts. Much more remains to be done.

The whole problem of increasing potato consumption, whether in fresh form, in food products, or non-food by-products, is tied up with the matter of warehousing, grading, and packaging. A greater volume of attractively packed and well-graded potatoes in the retail store would increase consumer demand. At the same time, the culls and off-grade withheld from these offerings would provide the basis for a permanent by-products industry. The development of new uses, both food and non-food, awaits only the intelligent application of research principles in both Government and private laboratories. After years of Governmental expenditures to support potato prices, it should now be clearly apparent that one of the most promising and effective sources of relief would be the activity of the industry itself in finding and applying the answers.

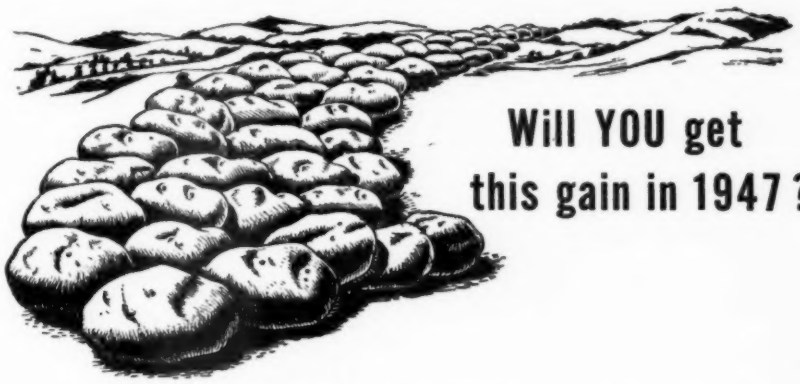
SECTIONAL NOTES

ALABAMA

The potato growers in Alabama have experienced most peculiar weather conditions this season. January resembled April. February was the coldest in more than 40 years, according to the Mobile weather bureau. March has been cold and wet with storms which usually produced 4 to 6 inches of water about once a week. Early March gave us temperatures that were so near freezing that growers had the blues. Hail has done a considerable amount of damage in certain small areas. Despite all this, the prospects seem to be about normal according to well-informed growers and dealers. Doubtless some loss of fertilizer has occurred, water has damaged a certain amount of low areas, and the entire crop is, as of today, a week to ten days behind our normal planting period.

No late blight has been reported to date. That is probably due to the winds that have more or less kept the plants dry during the day or to the fact that our crop is not far enough developed. Very little has been done so far for the control of blight because of weather conditions in March. Most of the potatoes will either be dusted or sprayed for blight control. There is a tone of confidence among most of the growers about blight. They used the best seed they could secure, planted most of the crop within a 10-day period, and have made special efforts to give proper drainage to fields where it was possible. In other years

POTATO YIELD INCREASED 25 BARRELS PER ACRE!



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Last year, DDT definitely proved itself as an effective agent for controlling infestations of the Colorado Potato Beetle, Potato Flea Beetle and Potato Aphid. Tests conducted at Federal and State Experiment Stations, as well as actual crop figures, indicated an average potato yield increase of *25 barrels per acre* through control of these insect pests.

A Penco DDT program this year will help you show substantial increases, too. Penco DDT compounds are made by Pennsalt—a leading basic producer of DDT—are high-quality, dependable, *proven* in actual use. Let your Penco Distributor assist in selecting the right formulation, and the proper application of DDT for real results. See him today.

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these practices have paid dividends to the growers. Should blight be found soon, and everybody expects it will be, most of the growers will attempt control measures in earnest.

It has been announced that the Potato Tour will be had again this year for the first time since the beginning of the War. Details have not been announced, but are being worked out at this time. This has been and doubtless will be an important event in South Alabama. In the past the Tour was held just before the opening of the sheds for business.

Most of the Certification Samples and Index plantings at the Gulf Coast Substation have not been damaged by the weather. Observations for plant diseases will begin next week. (Apr. 6.)—FRANK E. GARRETT.

CALIFORNIA

Other potato-producing areas are probably waiting for an announcement of the acreage of potatoes planted in Kern County for 1947. No survey has yet been completed for this county and anybody's guess is about as good as another's. Generally speaking, the consensus of opinion at the present time is that the acreage will be between 47,000 and 52,000 acres planted in the floor of the valley, with approximately 2700 acres yet to be planted in the mountain area. The early section in the Edison district is now up and in some fields the rows are completely filled by the plant growth. All growers in the Edison district have their fingers crossed with reference to frost. Frost could happen in this area as late as the 15th of April. We have no frost, to date, since the potatoes were out of the ground and the plant growth in most fields looks very good.

This is a considerable reduction in acreage from last year, when we harvested approximately 65,000 acres. Many seed growers sold seed for commercial consumption this year. By this time next month the diggers will be running and new potatoes from this area will be rolling in car lots to various portions of the United States. (Mar. 24).—M. A. LINDSAY.

GEORGIA

There is very little potato information in Georgia that would make news at this time. Several of the counties in northern Georgia are now receiving car lot shipments of certified seed potatoes. I do not know how many of these cars will be used in the state as yet. More preparation is being made on disease control on the potato crop than has been done before. (Apr. 4).—ELMO RAGSDALE.

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Powco Brand JP No. 50 is a micron sized DDT dust concentrate containing 50% by weight of technical grade DDT. It is ideal for the manufacture of finished dusts and is compatible with pyrethrum, rotenone, sulphur, coppers etc. It is a free-flowing dust of extremely fine particle size, colored red for identification and chemically standardized to assure high quality and maximum effectiveness.

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INDIANA

Judging from the inquiries we get concerning potato seed, it looks as if almost every one in Indiana is going to plant during the season of 1947. The main requests to date are for the Sebago and Sequoia seed,—with a few spattering reports of Katahdin and Irish Cobbler. There is a very definite trend toward these varieties, in which people are asking for quantities varying from a few hundred pounds to carloads of them. There seems to be very little seed available at this time, unless some one is holding out.

Most of our potatoes will be planted from the middle to the latter part of May. The early crop of Irish Cobbler in the southern part of the state has already been planted and the growers in central and northern Indiana are preparing their ground for their main crop, which will be planted on muck during the latter part of April.

Those who deal in potato seed need to be re-educated as to the demands, and it makes it rather difficult for the small grower to buy limited amounts of seed when he doesn't need a carload. I hope this situation does not prevail elsewhere. (Apr. 1).—W. B. WARD.

KENTUCKY

Potato planting began on the 11th of March. From preliminary intentions to plant, it appears that the state's commercial average will be reduced about 12 per cent. (Mar. 21).—JOHN B. GARDNER.

MAINE

Although Maine continues to be in the headlines because of the amount of potatoes dumped this winter, much of the criticism is unjustified. Potatoes which were dumped were deteriorating or were endangering other potatoes.

Maine has supported the export deals to the fullest extent. Dealers and farmers furnished potatoes for the export deal at support prices even though the potato market was often above support price. This was a real sacrifice to some, but dealers and farmers believed they were under moral obligation to make the potato program work even though at times it meant a sacrifice on their part.

Maine furnished 7394 cars of potatoes to the export deals by the 1st of April. Maine shipments for March smashed all existing records. Several days during the month shipments exceeded 600 cars. Some estimate that Maine may ship about 56,000 cars this year. In 1946 Maine shipped 54,301 cars.

Potato allotments have been forwarded growers by the A. A. A.

THINK NOW of the Fall Crop!

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It is believed that nearly all farmers will participate. Many farmers are asking for higher goals but acreage has been allocated, so few, if any, increases can be granted. Maine's allotment is 186,000 acres for 1947. Last year's acreage was 219,000 acres.

Indications are that a Marketing Agreement is being considered for the 1947 crop, among other support features. Some farmers are interested but few know anything about it

A bill was introduced into the legislature to increase the state potato tax from one to two cents per barrel. Provisions of the bill were explained at a series of meetings throughout Aroostook County. The attendance was not high, but the farmers present voted about two to one against any increase. The bill was, therefore, withdrawn. (Apr. 5).—VERNE C. BEVERLY.

MICHIGAN

April has finally arrived as it always does here in Michigan, and March is over. March is a month we always like to have behind us. This year it came in like a lion, and went out a much bigger lion.

The potato market has been dull all season, with shipments below those of a year ago, although there was a much larger crop to move. The government program for removing surplus was slow in starting, and is still moving slowly with much confusion. There was some dumping of low grade stock and sales for livestock feeding,—followed by shipment on foreign orders,—which helped considerably. Bad roads and storms hampered these programs. The present foreign program is scheduled to end the 7th of April, and Michigan is going to need further help to dispose of its surplus.

Our certified seed movement has been slow, and it does not seem likely that sales will equal those of last year.

With the hiring of a full-time secretary-manager, the Michigan Potato Development Association has launched an active program to improve the grading and inspection of potatoes in the state. This is to be followed by a merchandising campaign, built around a quality consumer package, stamped and approved by the Association. (Apr. 5).—H. A. REILLEY.

NEW JERSEY

From all the information received to date it seems that a very large percentage of New Jersey growers will comply with their acreage allotments and that the 1947 acreage will be very close to the 56,400

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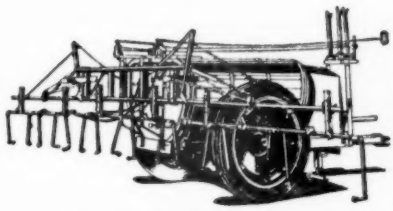

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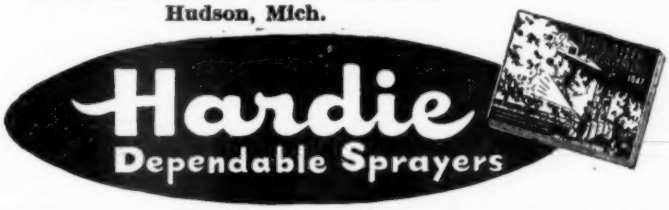

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acres that have been allotted to growers. Few growers are inclined to take a chance on producing potatoes that are not eligible for price support, since the Department of Agriculture has announced that it may sell surplus potatoes on the market at prices below support.

A few growers planted some potatoes last week, but on the whole most of our growers are afraid to venture because of the low temperatures that have existed. With warmer weather in prospect it is anticipated that planting will possibly get under way throughout the state within a week, with the exception of the northern portion.

Marketing agreements suggested by the U. S. D. A. are definitely out for this year's crop in New Jersey because of insufficient time to make all the necessary arrangements according to advice from a P. M. A. meeting held in New York City last week. (Apr. 5).—J. C. CAMPBELL.

NEW YORK

As this is being written, on the 1st of April, the ground is covered with snow and morning temperatures run as low as 4 degrees. Some of our main highways are practically one-way highways because of snow banks. A year ago last week a lot of oats was sown but this year it looks like it will be three or four weeks before we can get on the ground. In other words the season is late.

Intentions to plant for New York State are indicated as 88 per cent of last year but actual plantings may be less than this. There is a strong attitude at present toward reducing acreage.

Seed movement has been slow because of the weather, delays in getting out farm acreage allotments and an uncertainty as to the general situation. Table stock business has been good at prices competing with support levels.

Much interest is being expressed in the recent announcement of the 1947 program. Most growers are very much in favor of giving the public a better grade of potatoes.

Marketing agreements are being discussed in a series of meetings this week. Preliminary advices indicate that growers are concerned about the operation of marketing agreements unless some special arrangements can be made to take care of low grades and off sizes. With so many markets so close by there will be a strong tendency for these fringe grades to find an outlet.

Much interest is being shown in new varieties, especially Teton of which about 2000 sacks are being planted for certification. Besides its resistance to ring rot it has been found to be an excellent keeper, high

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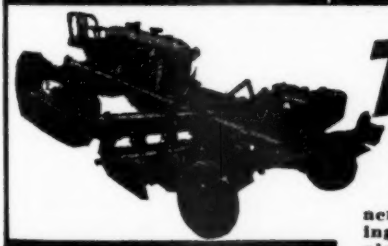

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yielder and a better potato for shipping than any of our standard varieties including Russet Rural.

The Erie which is a sister of Teton is also becoming popular because of its good keeping qualities as well as high yielding ability and resistance to ring rot.

All available supplies of the blight immunes will be planted and it is expected that some will be available for distribution next year. Virgil, Essex, Madison and Chenango seem to be in greatest demand. (Mar. 31).—W. G. Evans.

OHIO

The weather has warmed during the past few days and planting of the early crop is just starting. Our planting operations will be about 15 days later than a year ago. The acreage in Ohio is expected to be approximately the same as last year.

It looked for awhile as if some of the Russet potatoes in this state would have to be dumped. During the heavy snow in the East, shipments from out-of-state areas were practically stopped and during that period the markets took all of the Russets so that the old market in this state has cleaned up and there have not been any local potatoes on the markets for about two weeks. (Apr. 4).—E. B. Tussing.

RHODE ISLAND

The 1946 potato crop is just about cleared up, much to every one's relief. Potatoes have moved much better than anticipated during the past few weeks. Many dairy farmers are regretting that there are no more available for cattle feed. They claim that they can not keep up milk production without them, regardless of what other feed they have. This may prove to be a valuable outlet for the poorer grades of potatoes in the future, now that the dairy farmers have learned of their value.

A group of potato growers got together at the Southern New England Farm and Home Show and organized the Rhode Island Potato Growers' Association. The Executive Committee has held two meet ings since its organization. This committee is placing most emphasis on ways and means of improving the marketing program in the state. By the way, the growers had a very attractive exhibit at the Show,—advertising their product.

Newport County growers are well under way with their planting. Many plan to finish by the end of next week. Spring is opening up rather slowly in Southern Rhode Island. It will be another ten days before many potatoes will be planted. Most growers are planning to

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stay within their allotments in order to be eligible to participate in the price support program.

A study of the fertiliy levels of Rhode Island potato soils has been made, and the chemical tests show that reserves of phosphorus and potash have been built up in the soil, especially where potatoes have been planted continuously for a number of years. Plans are under way to carry out careful fertilizer studies on at least four farms to determine the proper ratio and amount of fertilizer to use for most profitable production. (Apr. 5).—AVERY E. RICH.

SOUTH DAKOTA

Potato acreage goals have been released to growers in South Dakota and are slightly lower than the 1946 acreage. South Dakota growers have been reducing their acreage, so the 1947 goals will not cripple any of the commercial producers.

The 1946 crop is about cleaned up. Approximately 200,000 bushels were piled in fields last fall by producers who lacked storage, and about 200,000 bushels were dumped during the winter, where the potatoes were deteriorating because of disease or crowded storage conditions.

Recently 101 carloads of white potatoes were shipped from South Dakota to Beaumont, Texas, for export as seed potatoes to Germany.

At the annual meeting of the South Dakota Potato Growers' Association, Chas. A. Larkin of Clark was re-elected Chairman; David Giese, formerly of Moorhead, Minnesota, head inspector, has established an inspection office at Clark.

Indications are that the acreage to be entered for certification will be around 7,000, about the same as in 1946, but less than the acreage entered in 1945. A number of cars of foundation Triumph and Cobbler seed have been secured from Wisconsin, Minnesota and North Dakota.

Growers feel that the Government support program has helped them over some rough spots, and they have under consideration, a marketing agreement, for the 1947 crop, where culls and grade outs will be kept off the market. (Apr. 3).—JOHN NOONAN.

WASHINGTON

The commercial potato market in Washington has been stimulated by the volume purchased by the Government for dehydrating. Over 700,000 tons of potatoes have been purchased in Washington, Idaho and Oregon to be dehydrated at the plant at Lynden, Washington. This tonnage will produce more than 120,000 tons of dehydrated material for European shipment. Individual allotments have been set up and the growers have been very cooperative in signing up.

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It has been indicated that plantings this season will be approximately 86 per cent of the 1946 crop. Our test plot readings made at Oceanside, California, during February indicate that the seed grown this year is the best that has been offered for sale since test plot work started. There will be more Netted Gem and White Rose foundation seed available this year than the market will absorb. (Apr. 7).—HAROLD S. SCHAAD.

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Because of wide climatic and soil differences, potato growers should consult their official agricultural advisers about the best fertilizer for their needs and the best way to apply it. To grow a good crop of No. 1's, soil and fertilizer must supply at least 200 lbs. of available potash (actual K_2O) per acre. Potatoes are greedy feeders on potash, using more of this plant-food element than nitrogen and phosphoric acid combined.

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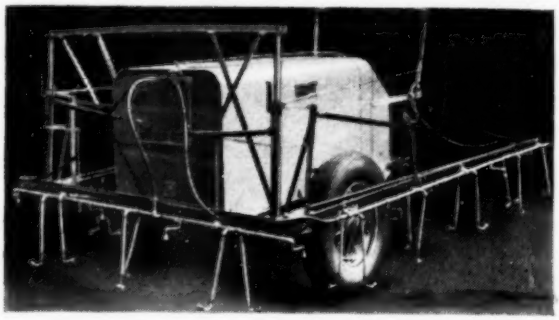

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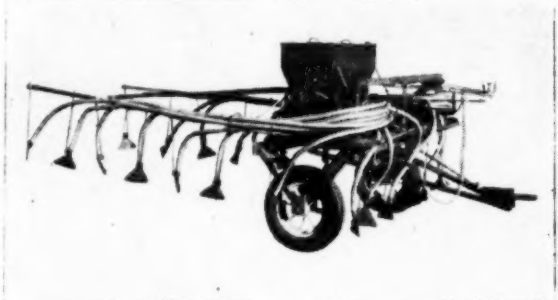

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